Tennessee Pollution Prevention Partnership Success Story

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Painting Progress Benefits Environment

The Member

Saturn Corporation, a General Motors subsidiary, has a highly integrated automotive manufacturing and assembly complex of over seven million square feet in Spring Hill, Tennessee. Approximately 7,000 Saturn team members are involved in producing spaceframe components and body panels, painting vehicles, manufacturing engines and transmissions, auto assembly, warehousing for retailer parts, and ancillary activities. The facility produces S-Series Saturn sedans, coupes and compact SUVs.

The Story

Saturn has made a variety of process and environmental improvements since initial production in 1990, including efforts to reduce air quality impacts from painting operations. The amount and type of air emissions created during painting depends on the paint formulation, the application techniques used, and the level of pollution abatement on the exhaust stream.

Paint ingredients
Saturn was the first automotive plant to start-up with "water-borne" basecoat paints, the paint layer which gives color to the vehicle exterior. However, these water-borne basecoats, generally containing 50-75% water, also contain solvent ingredients classified as "volatile organic compounds" (VOCs). Examples of VOCs in paints include butyl alcohol, methyl alcohol, methyl isobutyl ketone, xylene, ethylene glycol ethers, and acetates, among others. The solvents act as a means of applying the paint solids to the exterior parts. The paint solids contain metal compounds, which remain on the part and give it color, while the solvent portion evaporates.

Paint process
A paint coating is typically prepared by blending paint and thinners in a mix tank. The mix is then pumped to a paint booth where robots spray-apply it onto clean plastic or stamped steel parts. Finally, the paint is cured in an oven.

Air emissions
The majority of the paint-related VOCs is released to the air in the spray booths and drying ovens, and is treated by air pollution control devices. Some VOCs have been designated as "Hazardous Air Pollutants" (HAPs) or "Toxic Chemicals" by the EPA. Saturn has worked with paint suppliers to adopt new paints and coatings with fewer HAPs and Toxic Chemical ingredients.

Saturn recently replaced robots and base coat application equipment, adopting an innovative technology: electrostatic application of water-borne paints. Electrostatic painting has been used with solvent-borne paints in the auto industry since the 1980's, but only recently with water-borne paints.

The robots impart an electrostatic charge on the water-borne paint, which significantly improves the paint solids transfer efficiency, thereby reducing basecoat paint usage. Another feature of the new robots is their flexibility. They are able to reach each surface of the vehicle more accurately than the older equipment, drastically reducing paint over-spray and thus wasting less paint.

The Success
With the improved robots and electrostatic technology, Saturn more than doubled the amount of basecoat paint ending up on the car parts, with paint overspray collected in a water system for treatment. The improvement translates into an estimated 40 percent reduction of the amount of paint that Saturn uses annually and a reduction in the volume of paint sludge generated.

Previously, paints contained 7-11% HAPs and 9-14% Toxic Chemical ingredients. Five recently-adopted environmentally preferable base coat paints contain less than 1.5% HAPs and less than 2% Toxic Chemicals.

These efforts involved the planning and teamwork of production, maintenance, engineering, and many other Saturn team members. For example, adopting new paints requires extensive development and analysis to maintain key product characteristics and operational efficiencies.

Changes have resulted in significant benefits, including:

1. Improved productivity, first-time quality and uptime (fewer parts to re-paint)
2. Improved safety due to decreased use of hazardous chemicals
3. Cleaner paint booth environment
4. Reduced use of booth clean up materials
5. Reduced costs for paint, clean-up, and waste management

This process change directly contributed to business and financial goals. Expenses for purchasing paints, cleaning paint booths, utility and other chemical costs, as well as the waste management costs for paint sludge, were reduced.

The Pollution Prevented

Improvements included approximate reductions of 146 tons per year of air emissions, 167 tons per year of solid waste, and 455 tons per year of hazardous materials.